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## Environment, Safety, Health Directorate

## Waste Management Services

# Technical Procedure

# WM-SVS Characterization Services
# User-Performed Calibration (UPC) Program

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# 1.0 INTRODUCTION

## 1.1 Overview

Los Alamos National Laboratory (LANL) Procedure P330-2, *Control and Calibration of Measuring and Test Equipment (M&TE)*, requires the establishment of a Measurement Assurance Program and/or a User-Performed Calibration (UPC) Process, as applicable. This UPC has been developed in accordance with the authorization provided in QPA-VAR-2013.

This program ensures that qualified individuals perform measurement control and develop measurement control and calibration procedures. Nondestructive analysis (NDA) instruments used for accountability, confirmation, and verification measurements are maintained by the Waste Management Services (WM-SVS) Characterization Services Team. NDA reference standards used for instrument control and calibration are certified for use by the Standards and Calibration Laboratory (S&CL) before use. The Characterization Services Team performs the measurements, develops procedures for performing instrument UPC, and ensures the measurement systems' control before measurements are performed.

## 1.2 Purpose

The purpose of this plan is to document how the WM-SVS Characterization Services Team implements the UPC process according to P330-2, *Control and Calibration of Measuring and Test Equipment (M&TE).* This User-Performed Calibration Program Plan documents the systems, programs, procedures, and training/qualification to the extent necessary to ensure the quality of user-performed calibrations and such calibrations are performed with sufficient accuracy and traceability, in accordance with controlled procedures, to support the objectives of the activity.

## 1.3 Scope

This UPC Program applies to trained and qualified personnel performing calibration of Phoswich detectors and gamma-spectroscopy systems in Technical Area 54 (TA-54), Area G.

The two types of sensing devices that are calibrated are Phoswich detectors used with Green is Clean (GIC) waste verification systems and gamma-spectroscopy systems. High-purity germanium (HPGe) detectors are used to identify and quantify radionuclides in radioactive wastes for the purposes of repackaging or disposal, all around TA-54, Area G, and other sites around LANL. Phoswich detectors determine whether low-density waste from radiological areas contains radioactivity above background levels.

M&TE Use: Under this program, quantitative data are collected for use in reports and publications. Radionuclides in radioactive wastes are identified and quantified for purposes of repackaging or disposal and for determining whether low-density waste from radiological areas contains radioactivity above background levels.

M&TE Performance Requirements: M&TE must meet a functional requirement. HPGe detectors are used to identify and quantify radionuclides in radioactive wastes for purposes of repackaging or disposal. Phoswich detectors, used in the GIC waste verification systems, determine whether low-density waste from radiological areas contains radioactivity above background levels.

Justification for a UPC: Calibration of M&TE is not supported by S&CL, including outsourcing.

Calibration of M&TE: All M&TE will be calibrated at TA-54, Area G, Building 2.

## 2.0 ROLES AND RESPONSIBILITIES

### 2.1 Group Leader

1. Ensures that workers calibrating gamma-spectroscopy systems, Phoswich detectors, and Canberra Q2 System have completed the training requirements.
2. Ensures that the quality assurance (QA)/quality control (QC) measures described in this UPC Program Plan are followed and the objectives of the QA/QC program are routinely achieved.

### 2.2 Responsible Line Manager/Team Leader

1. Ensures the gamma-spectroscopy detector systems, GIC verification systems, and associated laptops or desktop computers are maintained in proper working condition.
2. Ensures periodic calibrations are performed and documented.
3. Ensures the QA/QC measures described in this plan are performed as required.
4. Initiates and closes nonconformance reports (NCRs) as required.
5. Maintains records of calibrations performed under this plan.
6. Periodically reviews the daily QC results to ensure the gamma spectroscopy and GIC verification equipment is functioning properly.
7. Provides or supervises on-the-job training (OJT) for new personnel assigned to perform any portion of this procedure and maintains training documentation in accordance with P-781-1, *Conduct of Training Manual.*

### 2.3 Gamma Spectroscopy Technician

1. Ensures all measurements are performed in accordance with the requirements of this UPC Program Plan.
2. Ensures documentation of measurements is maintained as required by this program plan.
3. Promptly reports all functional problems with the waste verification systems to the team leader.
4. Maintains training pertinent to performing these duties as required.
5. Advises the team leader of necessary or desired changes to this procedure as a result of actual experience or lessons learned.

## 3.0 ELEMENTS OF THE UPC

### 3.1 Document Control

Documents that prescribe processes, specify requirements, or establish design are controlled to ensure the most current, reliable, and approved documents are used. ADESH-AP-007, *Document Control,*

defines the process used for controlling, maintaining, and distributing procedures, plans, and other types of controlled documents. This procedure establishes consistency in the document control process for WM-SVS in meeting the requirements of P1020-2, *Laboratory Document Control Program*; P300, *Integrated Work Management*, and P315, *Conduct of Operations Manual.*

### 3.2 Records Management

The WM-SVS procedures for the identification, collection, retention, recall, indexing, access, filing, storage, maintenance, and disposal of quality and technical records associated with the WM-SVS UPC Program plan are covered in ADESH-AP-006.1, *Records Management Plan*. This procedure provides the formal methods to identify, generate, submit, authenticate, index, maintain, store, transfer, and disposition records of work activities performed within the Associate Directorate for Environment, Safety, and Health (ADESH). The ADESH Records Management Plan (RMP) is written in accordance with the requirements contained in LANL policy P1020-1, *Laboratory Records Management*. It also conforms to the QA requirements contained in the LANL Quality Assurance Program SD330.

The UPC responsible line manager (RLM)/team leader ensures calibrations are performed, documented, and up-to-date and performs periodic reviews of the daily QC results to ensure gamma-spectroscopy equipment is functioning properly. Records of calibration data shall be maintained by the UPC RLM both electronically and in hard copy formats. Currently, all hard copy calibration records are maintained and stored at TA54-246-104. Electronic copies are maintained and stored on a local area network server.

### 3.3 Training

The UPC RLM/team leader ensures the competence of all personnel who perform calibrations, evaluate results, and sign calibration reports. The UPC RLM/team leader also ensures personnel operating and calibrating gamma-spectroscopy and Phoswich detection systems have completed all training requirements and they maintain training documentation in accordance with P781-1, *Conduct of Training Manual*. Additional training to perform system calibration includes a minimum of 8 hours of informal OJT by a person knowledgeable about and trained in the calibration of the system. Individuals performing calibrations shall have a degree in a scientific discipline and previous experience or equivalent experience. Specific training, as identified in UTrain, is listed in Tables 1–3.

Tables 1–3

**Table 1. Gamma-Spectroscopy Calibration Training**

| Course # | Description |
|---|---|
| 21402 | Operation and Calibration of Spectroscopy Systems OJT |

**Table 2. GIC Verification Systems Calibration Training**

| Course # | Description |
|---|---|
| 21833 | Phoswich Detector Calibration Technician OJT |

| Table 3. Canberra Q2 Calibration Training | |
|---|---|
| Course # | Description |
| 24972 | Canberra Q2 Operations OJT |

### 3.4 Implementing Procedure(s)

The WM-WVS UPC program includes the following documented, approved, and controlled procedures for all UPC activities:

- EP-DOP-2203, *Operation and Calibration of Spectroscopy Systems*
- EP-DOP-2206, *Calibrating Phoswich Detectors*
- EP-DOP-2207, *Canberra Q2 Operations*

These calibration procedures contain the following information:

- Description of the type of item to be calibrated
- Parameters or quantities and ranges
- Apparatus and equipment, including technical performance requirements
- Reference standards and/or reference materials to be used and requirement to verify the calibration status of the standards
- Environmental conditions required and any stabilization period needed
- Description of the process including the following:
    - Performance and documentation of as-received measurements
    - Checks that the equipment is working properly
    - Calibration and adjustment of the M&TE
    - Method of recording the results
    - As-left measurements
- Criteria for approval or rejection
- Data to be recorded
- Development of tolerance/uncertainty
- Requirement and process to review history of previous calibrations to determine if tolerances are reasonably assured for the calibration interval.

The WM-SVS calibration procedures for gamma-spectroscopy and GIC verification systems are in full compliance with the requirements of P300, *Integrated Work Management*. EP-DOP-2203, *Operation and Calibration of Spectroscopy Systems*, describes the calibration of gamma-spectroscopy systems for WM-SVS. EP-DOP-2207, *Canberra Q2 Operations*, describes the calibration of Canberra Q2 Gamma Spectroscopy System (Q2 System) for WM-SVS. Both of these procedures apply to trained and qualified

personnel operating or calibrating a gamma-spectroscopy system to acquire spectral data from which reports and records will be generated.

EP-DOP-2206, *Calibrating Phoswich Detectors*, describes the calibration of Phoswich detectors used with GIC waste verification systems and applies to all trained and qualified personnel performing calibration of Phoswich detectors in TA-54, Area G. This procedure provides detailed instructions for energy calibration of the NaI and CsI portions, absolute efficiency determinations, and setting the multiplexer gate to separate NaI and CsI signals.

### 3.5 Quality Controls

The instructions/procedures listed in Section 4.4 above define the individual instruments' calibration quality requirements. These controls ensure the monitoring of calibration validity and a calibration performance commensurate with the accuracy/uncertainty required of the calibrated instrument. These controls include the following, as required:

- Use of certified reference standards or reference materials
- Training
- Monitoring methods used to evaluate the performance of the M&TE
- Subject matter expert technical and quality reviews conducted by personnel performing UPC

All assay systems are maintained in good working order. QC checks are normally performed once daily when the spectroscopy systems are used to collect quality data. Quality data are bracketed by successful QC checks on consecutive days of system use. QC checks may also be conducted when the gamma spectroscopist suspects the system is not performing satisfactorily. However, QC checks are normally performed twice daily (once at the beginning of the day and once at the end) when a system is used to assay accountable amounts of special nuclear material.

Calibration sources are leak checked annually by Radiation Protection Division, Radiation Protection Programs (RP-PROG). Check organization name-changed with transformation.

Calibration problems with Phoswich detectors and spectroscopy systems will be investigated by the UPC RLM/team leader. Problems identified and any subsequent corrective actions taken will be documented in the log book. The UPC RLM/team leader shall communicate to staff any lessons learned and corrective actions that have been implemented.

Components or equipment found to be unacceptable for use are considered to be nonconforming and will be separated from acceptable items or identified in a manner that will preclude inadvertent use as an acceptable component.

Measurements and calculations associated with calibrations will be fully documented and filed with Records. Processes developed to identify, report, and correct conditions adverse to proper functioning of the GIC system components are incorporated directly into the applicable sections of EP-DOP-2206, *Calibrating Phoswich Detectors,* and EP-DOP-2204, *Green is Clean Waste Verification Systems*. QA processes of spectroscopy and Q2 systems are outlined in EP-DOP-2203, *Operation and Calibration of Spectroscopy Systems,* and EP-DOP-2207, *Canberra Q2 Operations*.

### 3.6 Out-of-Tolerance and NCR Processes

Activities, items, and containers shall satisfy approved design specification, regulatory requirements, process—specific parameters and procedural requirements. Components or equipment found to be unacceptable for use are considered to be nonconforming and will be separated from acceptable items or identified in a manner that will preclude inadvertent use as an acceptable component. NCRs shall be generated in accordance with P330-6, *Nonconformance Reporting*, as required.

Once a potential nonconforming condition is identified, the NCR initiation, immediate actions to control the nonconforming item(s), notifications, and entry into the electronic NCR System should be performed the same day the condition was identified. Once a nonconforming condition is identified, the nonconforming item should be segregated and an NCR Hold Tag should be affixed to the item. A final disposition should be established within 60 calendar days. Time to close out nonconforming conditions may vary greatly because of the variation in work required. As a goal, a target of 180 calendar days from initiation is established for closure of the NCR.

Calibrations performed under this UPC Program plan that result in an out-of-tolerance (OOT) condition will be defined as noncompliant and, therefore, may result in the generation of an NCR. However, the item calibrated through this process will be dispositioned “as-left.” The NCR generated will be used to document the investigation of impact to people, product, or environment affected and to disposition those measurements to provide confidence to parties impacted. The identified OOT condition shall be identified as the root cause for the condition, which must be determined as identified in P330-2, *Control and Calibration of Measuring and Test Equipment,* and P330-6, *Nonconformance Reporting.*

WM-SVS demonstrates confidence in accountability values for items measured between the last successful measurement-control point and the instrument-failure point. The level of instrument failure is taken into consideration (i.e., if an instrument used to establish accountability values suffers a failure because of statistical variability, a series of normal, passing measurement-control checks is required to clear the failure). Measurement-control data are collected and must pass within the specified control limits on the detection system. The data requirements depend on the instrument type and the type of failure.

Instrument failures include broken parts, drifting electronics, incorrect settings, short-term high background situations, and other failure mechanisms. The data requirements for these failures are instrument-dependent, and WM-SVS provides a documented reason for the failure and a description of the corrective actions taken. If instrument response has changed, consult EP-DOP-2203, *Operation and Calibration of Spectroscopy Systems*, or EP-DOP-2206, *Calibrating Phoswich Detectors*, for requalification requirements.

The UPC RLM/team leader validates the following completed actions after a documented OOT event:

- Reviews the measurement-control data entered after trained personnel perform any corrective actions
- Communicates to staff the lessons learned and any corrective actions that have been implemented
- Approves a restart of equipment following a corrective action

### 3.7 Inactivation and Closing Calibration Processes

Items no longer required for use but are still functional will have a closing calibration to validate the measures taken during the interval were acceptable. HPGe and Phoswich detectors are inactivated or removed from service when they are damaged and not repairable; therefore, a close-out calibration is not feasible. In this case, a nonconforming condition exists and an NCR will be written per P330-6, *Nonconformance Reporting,* and the item inactivated/rejected to address measurements taken during the current interval and provide justification for why they are or are not acceptable or in or out of tolerance, respectively. Update of the item status in the recall database will take place upon final disposition, and an "Item Inactive" sticker will be affixed to the item.

Rejected items may be scrapped (destroyed or sent to salvage), returned to the supplier, or used for another purpose (e.g., "training purposes only") as directed by the "Reject" disposition. In all cases, items will not be used for their original intended design and will be clearly identified by marking/labeling and/or segregating the item. For traceability purposes, a final closure statement detailing the specific actions taken should be referenced in the NCR and Closing Calibration document or Inactivation documentation (e.g., returned to vendor per MTR #99999, destroyed on 8/15/2014 by <employee name>).

### 3.8 UPC Label Control

If the UPC-calibrated M&TE item has met all the applicable specifications, a "Certified" label (Figure 1) is attached to the M&TE by the UPC calibration personnel. If the UPC calibrated the M&TE but (1) only a subset of available functions, ranges, or attributes was tested; (2) the tolerance limits that apply to this item are not those that would ordinarily apply to an item of this type; or (3) the item does not meet applicable 4:1 Test Uncertainty Ratio, Guard-banding, or 95% calibration confidence, a "Limited User Performed Calibration" label (Figure 2) is attached. WM-SVS ensures that every piece of M&TE that is part of the UPC Laboratory Calibration Program is suitably labeled to indicate traceability to UPC processes as follows:

- Obtain uniquely identified UPC labels from the Standards and Calibration Laboratory
- Mark each with a unique M&TE number such as S&CL file number, serial number, asset number, etc.; the date the M&TE was calibrated; the date the calibration interval expires; the name or Z number of the person conducting the calibration; and a short description of limitations of the M&TE calibration.
- With each interval calibration, affix labels directly to the M&TE or placed near the M&TE such that it is accessible to M&TE users.
- Update electronic files when a new UPC instrument is put into service and put a uniquely identified UPC label on it.

- **List of Figures**

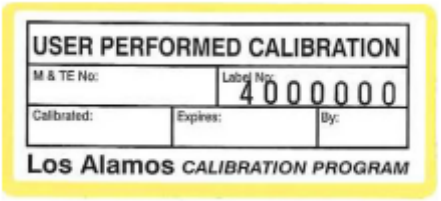


**Fig. 1 Certified UPC Label**

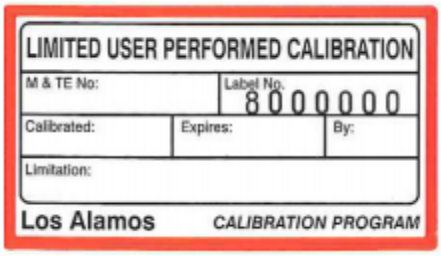


**Fig. 2 Limited UPC Label**

A "Calibrate before Use" label (Figure 3) may be requested for M&TE approved in a UPC Program as requiring calibration before use. The M&TE will be calibrated before each use when using standards calibrated by the S&CL or subcontractor operating under the auspices of the S&CL. The UPC Calibrate-Before-Use label is affixed to or near the M&TE the first time it is calibrated.

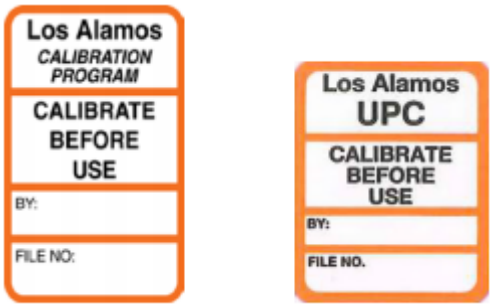


**Fig. 3 Calibrate Before Use Label**


**Fig. 4 Item Inactive Label**

### 3.9 Software Quality Management

The UPC RLM ensures appropriate software quality is implemented through P1040, *Software Quality Management,* Section 2.2, when computers or automated equipment are used for the processing, recording, reporting, storage, or retrieval of calibration data. Some NDA and maintenance/test software qualifies as "acquired software" (i.e., commercial-off-the-shelf), and some as "Custom-Developed Software" built specifically for WM-SVS, embedded, custom-developed software that controls a hardware device, or software embedded in procured instruments, according to instrument type. Some software is categorized as "Safety Management and Administrative Controls Software," which performs hazard-control functions (e.g., protection by eliminating, limiting, or mitigating nuclear hazards to workers) in support of TA-54 and other TAs throughout LANL. WM-SVS performs software-configuration management, identification and management of requirements, and acceptance testing, as applicable, to ensure appropriate control and validation of the software.

### 3.10 Calibration/Reference Standards

WM-SVS spectroscopy and Phoswich detector systems are calibrated with traceable sources that are calibrated directly against National Institute of Standards and Technology (NIST) traceable standards. A certificate of calibration is provided for each traceable source and includes a statement of traceability, a complete description of the physical and nuclear characteristics of the source, a description of the calibration method, and quantitative identification of detected impurities. Activities are given in the Curie and International System of Unit systems. The traceable sources used to calibrate the spectroscopy systems are approved for use by the S&CL after review of the supplier's calibration documentation. A list of the current standards certified will be found within the S&CL customer database.

Each system is calibrated over a range of expected values, and accountability values exceeding the range of calibration are evaluated on a case-by-case basis.

### 3.11 Calibration Intervals

All M&TE energy and efficiency calibrations are performed every 2 years, or on an as-needed basis (for example, recalibration may be needed after repair, maintenance, or failure of response testing). The WM-SVS UPC Program Plan establishes and maintains calibration intervals for each detector to ensure an acceptable probability that the M&TE will remain in-tolerance throughout the interval. The UPC RLM/team leader will be responsible for maintaining and scheduling calibration schedules, evaluating the accuracy of the instrument, and/or have the M&TE recalibrated.

Calibration intervals will be based on the following considerations:

- the original equipment manufacturer
- type of equipment
- measured quantity and allowable tolerance range
- level of stress to which the equipment is subjected
- stability of past calibrations
- required measuring accuracy

- measurement assurance processes in place (i.e., control charting)
- requirements set by design, contract, or regulations (intended use)
- environmental factors that affect stability

If an instrument is found to be OOT during repeat calibrations, a nonconforming condition exists and an NCR will be written per P330-6, *Nonconformance Reporting.* The UPC RLM will reevaluate the calibration interval.

### 3.12 Recall System

The WM-SVS recall system is monitored and managed by the UPC RLM/team leader who has a database that tracks the M&TE calibration date and expiration. The UPC RLM/team leader shall implement a reasonable level of protection to prevent loss and degradation of all M&TE calibration records. Records, both electronic and hard copy, shall be retained for at least 2 years after the calibration expiration date before final disposition. When the records are ready for final disposition, the records are transferred to Records Management in accordance with P1020-2, *Laboratory Records Management*.

### 3.13 Uncertainty/Traceability

NDA equipment is calibrated and maintained to meet the requirements of U.S. Department of Energy Orders M 470.4-6, 10 Code of Federal Regulations 830.120, and QA requirements within LANL. Calibration ensures traceable accuracy in relation to national standards. NIST traceable sources suitable for calibrations are used to calibrate the gamma-spectroscopy systems and the GIC verification systems. The uncertainty of our measurements is a combination of the error from the detector systems, which is ~3%, and the uncertainties of the radioactive check sources that are used to calibrate our systems. The calculated uncertainties for the radioactive check sources are listed in Attachment 2.

Each check source has a calibration certificate from the manufacturer that is tracked and processed through the S&CL. The uncertainty of each check source is obtained by multiplying the standard uncertainty by the coverage factor k=2. The value of the uncertainty for each source lies within the assigned range of values with a probability of 95%.

M&TE is calibrated at TA-54, Area G, Building 2, and a report is generated listing the calibration procedure, measurement conditions, measurement results, and the uncertainty of the measurement. A checklist, titled *Intrinsic Efficiency Calibration Reviewer Checklist,* in EP-DOP-2203, *Operation and Calibration of Spectroscopy Systems*, must be filled out by the person performing the calibration of HPGe detectors. The calibrator must check that the intrinsic efficiency calibration fits the parameters of the PeakDoctor and SNAP system software and that the activities and energy ranges are correct.

### 3.14 Environmental Conditions

The environmental conditions for calibration are bounded by the common TA-54, Area G, acceptable conditions for an Area G worker. If the environmental conditions are acceptable for personnel, then they are acceptable for calibration. The operating temperature for spectroscopy detector instruments is ~5 to 40$^{o}$C; however, the Phoswich system requires ~70$^{o}$F ± 5$^{o}$ for stable operation. No other unique environmental conditions are required.

### 3.15 Equipment

The following documented, approved, and controlled procedures describe the setup, operation, and calibration, of the spectroscopy and Phoswich systems:

- EP-DOP-2203, *Operation and Calibration of Spectroscopy Systems*
- EP-DOP-2206, *Calibrating Phoswich Detectors*
- EP-DOP-2207, *Canberra Q2 Operations*

These calibration procedures contain the following information:

- Description of the type of item to be calibrated
- Requirements for safe handling, transport, storage
- Use and planned maintenance of measuring equipment to ensure proper functioning
- Parameters or quantities and ranges
- Apparatus and equipment, including technical performance requirements
- Reference standards and/or reference materials to be used and requirement to verify the calibration status of the standards
- Environmental conditions required and any stabilization period needed
- Description of the process include the following:
    - Performance and documentation of as-received measurements
    - Checks that the equipment is working properly
    - Calibration and adjustment of the M&TE
    - Method of recording the results
    - As-left measurements
- Criteria for approval or rejection
- Data to be recorded
- Development of tolerance/uncertainty
- Requirement and process to review history of previous calibrations to determine if tolerances are reasonably assured for the calibration interval.

Personnel performing measurements or calibrations must ensure that a working copy of each procedure is available at all times during the measurement or calibration process. Before operation or calibration, trained personnel should ensure that the gamma spectroscopy detector systems are maintained in proper working condition. Each piece of equipment listed in Attachment 1 is uniquely identified by a property number label that is affixed to each individual item.

All functional problems with the gamma-spectroscopy equipment shall be reported to the UPC RLM/team leader in a timely manner. To ensure each system is capable of achieving required accuracy and specification, QC checks are performed once daily when the system is used to collect quality data.

Quality data are data bracketed by successful QC checks on consecutive days of system use. QC checks may also be conducted when personnel suspect the system is not performing satisfactorily.

### 3.16 Calibration Reporting

The results of each interval calibration will be reported accurately, clearly, unambiguously, and objectively, onto QPA-DO Form SCL-FM-0029, *User Performed Calibration (UPC) Record*. One form is filled out for each M&TE item: Phoswich detectors, HPGE detectors, and Q2 system.

The report will include following:

- Title (e.g., “Calibration Certificate”)
- Identification of the owner (WM-SVS)
- A configuration control that assures the report is traceable to the specific M&TE (i.e., unique M&TE number)
- Identification of the procedure used
- A description of, the condition of, and unambiguous identification of the item(s) calibrated
- The date(s) of performance of the calibration
- The calibration results with the units of measurement
- The name(s), Z number, signature, and date or equivalent identification of person(s) conducting the calibration and the person(s) authorizing the calibration
- A statement of the estimated uncertainty of measurement and/or a statement of compliance/non-compliance with requirements and/or specifications
- The conditions (e.g., environmental) under which the calibrations were made that affect measurement results
- Evidence that the measurements are traceable (a list of standards used)
- The calibration interval and calibration expiration date
- Standard ID(s)

## 4.0 DEFINITIONS AND ACRONYMS

### 4.1 Definitions

**Accuracy**— The quantity of closeness of a measured or specified value to the true value quantitatively expressed by uncertainty.

**Calibration** — The set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system or values represented by a material measure or a reference material and the corresponding values realized by standards.

**Certification** — The process of performing a calibration and assigning a certification uncertainty or tolerance (including any uncertainty because of use, environment, handling, or variation with time) and expiration criteria. At LANL, "certification" refers only to work performed by, or under the auspices of, the S&CL.

**Certification Uncertainty** — The uncertainty assigned to reference standards or M&TE consisting of the measurement uncertainty and any uncertainties associated with use (environment, handling, or variation with time). A certification uncertainty is valid until the certified equipment's expiration criteria have been reached.

**Check Source** — A radioactive source, not necessarily calibrated, that is used to confirm the continuing satisfactory operation of an instrument

**Measurement Assurance Program** — A program in which periodic measurements of a calibrated artifact or set of artifacts are recorded and analyzed to ensure the system remains in a state of control.

**Measurement Uncertainty** — An estimate of the range of values bounding the reported or measured value in which the true value is believed to lie. This range is an estimate of the bounds, inside which the value can be confidently asserted to lie.

**Measuring and Test Equipment (M&TE)** — Devices or systems used to calibrate, measure, gage, test, or inspect to control or acquire data to verify conformance to specified requirements.

**Quality-Affecting Measurement** — Measurements made to document the compliance of an item or system to requirements for the process of monitoring, acceptance, and certification or to demonstrate compliance with operating or permitting constraints.

**Reference Standard** — A piece of M&TE having a fixed value or set of values associated with a known standard, such as a NIST standard, that is used to perform a calibration. Reference standards may include any source that can provide a reference for the calibration of an instrument or comparison of material or components.

**Traceability** — A property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons, all having stated uncertainties.

**Tolerance** — The permissible limit of variation about a nominal value.

**Uncertainty** — A range of values, usually centered on the measured value, that contains the true value with stated probability.

**User Performed Calibration (UPC)** — A calibration process where the using organization performs calibrations to a documented process approved by the Quality and Performance Assurance Division (QPA-DO).

### 6.2 Acronyms

| | |
|---|---|
| ADESH | Associate Directorate for Environment, Safety, and Health |
| GIC | Green Is Clean |
| HPGe | High-Purity Germanium |
| LANL | Los Alamos National Laboratory |
| M&TE | Measuring and Test Equipment |
| NCR | Nonconformance Report |
| NDA | Nondestructive Assay |
| NIST | National Institute of Standards and Technology |
| OJT | On-the-Job Training |
| OOT | Out of Tolerance |
| QA | Quality Assurance |
| QC | Quality Control |
| RLM | Responsible Line Manager |
| RMP | Records Management Plan |
| S&CL | Standards and Calibration Laboratory |
| TA | Technical Area |
| UPC | User-Performed Calibration |
| WM-SVS | Waste Management Services |

## 5.0 REFERENCES

- P330-2, *Control and Calibration of Measuring and Test Equipment (M&TE) Procedure*
- QA-DO-QP-008.002, *User Performed Calibration (UPC) Program Implementation*
- ADESH-AP-006.1, *Records Management Plan*
- ADESH-AP-007, *Document Control*
- EP-DIR-SOP-2011, *Personnel Training and Qualification*
- EP-DOP-2203, *Operation and Calibration of Spectroscopy Systems*
- EP-DOP-2204, *Green Is Clean Waste Verification Systems Procedure*
- EP-DOP-2206, *Calibrating Phoswich Detectors*
- EP-DOP-2207, *Canberra Q2 Operations*
- PD1020, *Document Control and Records Management*
- P1020-2, *Laboratory Records Management*
- P300, *Integrated Work Management*

- P315, *Conduct of Operations Manual*
- P330-6, *Nonconformance Reporting*

## 6.0 ATTACHMENTS OR APPENDICES

**Attachment 1:** WM-SVS NDA UPC Instrument List
**Attachment 2:** WM-SVS NDA UPC Calibration Sources List

## ATTACHMENT 1 – WM-SVS NDA UPC INSTRUMENT LIST

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| Unique ID | Name | Item Description | Manufacturer | Managed by UPC or S&CL |
|---|---|---|---|---|
| PN955976-Chew | Q2 Chewbaca | HPGe Detector in Q2 System | Canberra Industries | UPC |
| PN955976-Obi | Q2 Obiwan | HPGe Detector in Q2 System | Canberra Industries | UPC |
| PN955976-Yoda | Q2 Yoda | HPGe Detector in Q2 System | Canberra Industries | UPC |
| PN955976-Q2 | Q2 System | Q2 System | Canberra Industries | UPC |
| PN1115028 | Bugs | HPGe Detector | Ortec | UPC |
| PN1233491 | Bullwinkle | HPGe Detector | Ortec | UPC |
| PN1124499 | Homer | HPGe Detector | Ortec | UPC |
| PN1238848 | Apollo | HPGe Detector | Ortec | UPC |
| PN947052 | Minnie | HPGe Detector | Canberra Industries | UPC |
| PN994865 | Sam | HPGe Detector | Canberra Industries | UPC |
| PN994874 | Taz | HPGe Detector | Canberra Industries | UPC |
| PN1133478 | Thor | HPGe Detector | Ortec | UPC |
| PN978744 | Tweety | HPGe Detector | Ortec | UPC |
| PN920228 | Ortec Pop-Top | HPGe Detector | Ortec | UPC |
| PN978802 | Zeus | Phoswich/GIC Verification System | Various | UPC |
| HERCULES | Hercules | Phoswich/GIC Verification System | Various | UPC |
| 1134852 | Rocky | HPGe Detector | Ortec | UPC |
| 1235733 | Shrek | HPGe Detector | Ortec | UPC |

## ATTACHMENT 2 – WM-SVS NDA UPC CALIBRATION SOURCES LIST

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| Id # | Description | Uncertainty (%) |
|---|---|---|
| 1451-74-2 | Am-241 gamma point source | 3.53 |
| 1468-95-1 | Ba-133/Eu-152 multiple gamma ray–emitting point source | 3.2 |
| 1451-74-1 | Ra226 | 4.19 |
| 1468-95-2 | Am-241/Cs-137 multiple gamma ray–emitting point source | 3.96 |
| 1468-95-4 | Cs-137 | 2.8 |
| 1468-95-3 | Co-60 | 2.78 |
| 1820-56-1 | Co-57 | 2.34 |
| 1820-56-2 | Co-57 | 2.33 |
| 1820-56-3 | Co-57 | 2.40 |
| 1820-56-4 | Co-57 | 2.34 |